Anesthetic Management and Postoperative Opioid Consumption after a Novel, Fusion-less Adolescent Scoliosis Surgery

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Introduction

Scoliosis surgery in adolescents is a major surgery with significant postoperative pain and a protracted recovery course (1,2). Anterior vertebral tethering (AVT) is a novel, fusion-less surgical approach that utilizes small incisions, endoscopy, and a synthetic "ligament" that serves as a potential alternative to traditional posterior spinal fusion (3, 4). This study aims to characterize the anesthetic and postoperative pain management after AVT at our institution.

Materials And Methods

Study Design

All primary AVT procedures performed in patients 10-21 years of age between January 2014 and August 2017 were identified in the electronic medical record. The authors extracted patient characteristics and perioperative data pertaining to anesthetic and pain management. Postoperative pain was rated using a visual analogue pain scale or FLACC scale where appropriate.

Statistical Analysis

Descriptive statistics on demographics, procedural, and perioperative data were generated using STATA statistical software. Stata statistical software (StataCorp. 2017. Release 15. College Station, TX: StataCorp LLC). Categorical data were summarized as proportions, and continuous data as either mean with standard deviation (SD)

Results

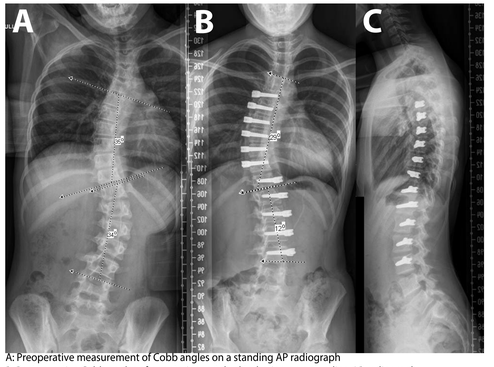
A total of 35 AVT cases performed by a single surgeon met inclusion criteria. Patient characteristics, procedural and postoperative details are summarized in Table 1. Most patients (n=30, 86%) underwent preoperative fluoroscopy-guided epidural placement. All patients received total intravenous anesthesia. No blood transfusions were necessary. The highest recorded postoperative pain score on post-operative day (POD) 0 was 6.5 (SD 2.3), and 5.6 (SD 2.3) on POD 1. Total in-hospital opioid consumption in morphine equivalents, excluding epidurally administered opioids, was 70 (SD 77) mg. Additional postoperative adjuncts included oral acetaminophen (n=34, 97%), ketorolac (n=24, 69%), and benzodiazepines (n=13, 37%). Antiemetics were required for 27 patients (77%). Epidural catheters were discontinued on POD 2.9 (SD 1), and patients were discharged home on POD 4.4 (SD 1.4).

Table 1. Demographics, procedural, and post-operative data for patients undergoing anterior vertebral tethering

	AVT (Mean ± SD) or n (%)
Age (years)	15.5 (±1.7)
Weight (kg)	57.5 (±11)
Height (cm)	164 (±7.6)
BMI[1]	21.5 (±4.2)
Gender (Female/Male)	30 (86%)/5 (14%)
Ethnicity (Caucasian/Other)	30 (86%)/5 (14%)
ASA[2] Status (1/2/3)	9 (26%)/23 (66%)/3 (8%)
Elixhauser Comorbidity Index (0/1/2/3)	23 (66%)/ 10 (28%)/ 2 (6%)
Preoperative Cobb Angle (degrees)	44 (±11)
Spinal Segments Tethered (n)	6.80 (±2.0)
Anesthesia Duration (min)	409 (±110)
TIVA[3] Technique	35 (100%)
Lung isolation (double-lumen tube/bronchial blocker)	21 (60%)/1 (2.9%)
Estimated blood loss (ml)	141 (±118)
Crystalloid administered (ml)	2379 (±1092)
Heterologous blood transfusion	0 (0%)
Surgical Complication[4]	7 (16%)
Epidural catheter placed	30 (86%)
Postoperative analgesic adjuncts	
Acetaminophen	34 (97%)
Ketorolac	24 (69%)
Benzodiazepine	13 (37%)
Postoperative Antiemetics	27 (77%)
Worst pain score on POD 0[5]	6.5 (±2.3)
Worst pain score on POD 1	5.6 (±2.3)
Average pain score on POD 1	3.1 (±1.3)
Average pain score on POD2	2.9 (±1.2)
Average pain score on POD 3	3.5 (±1.2)
Average pain score on POD 4	3.6 (±1.7)
Total in-hospital opioid consumption in morphine equivalents (mg)	70 (±77)
Discharge on POD*	4.4 (±1.4)

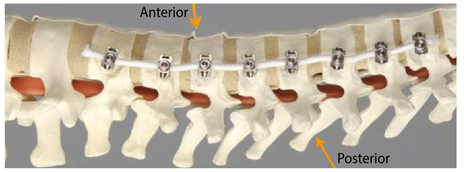
[1]Body Mass Index, [2]American Society of Anesthesiologists, [3]Total Intravenous Anesthesia, [4]Composite outcome (surgical site infection, perioperative skin injury due to pressure or burn, need for revision surgery within 30 days, persistent intraoperative neurologic deficit, postoperative neurologic deficit, severe atelectasis, other), [5]Post-operative day

Figure 1. Pre and post-operative radiographs of a patient undergoing anteior vertebral tethering



A: Preoperative measurement of Cobb angles on a standing AP radiograph
B: Postoperative Cobb angles after anterior vertebral tethering on a standing AP radiograph
C: Lateral view of lumbar and thoracic spine after anterior vertebral tethering

Figure 2. Anterior vertebral tethering ligament affixed with verbral body screws



Discussion

This study describes the perioperative management and postoperative pain control of 35 adolescents with adolescent scoliosis who underwent a novel surgical procedure for correction. Postoperative pain management was accomplished with a combination of neuraxial analgesia and non-opioid adjuncts. The data presented indicate adequate pain control and a short in-hospital recovery period, which compares favorably to outcomes after traditional fusion with typical discharge on later postoperative days and use of more narcotics (1,5). Another recent study detailing recovery after AVT reports overall lower pain scores, possibly due to the use of an aggressive multimodal analgesic protocol (6).

Conclusions & Significance

As one of the first studies examining pain outcomes after this novel, fusion-less scoliosis surgery, the data presented can help inform spine surgeons and their patients about the expected shorter recovery period and decreased postoperative narcotic requirement associated with AVT while serving as a baseline for future adjustments to perioperative care.

References

[1]Klatt et al., Spine (2013) [2]Willimon et al., J Ped Ortho (2017), [3]Samdani et al., Eu Spine J (2015), [4]Braun et al., Spine (2006), [5]Ravish et al., J Ped Ortho (2012), [6]Gal et al., Pediatric Anesthesia (2017)